

Reference = LEES 14E; PR D89 112004  
Verifier code = BABAR

*PLEASE READ NOW*



Normally we send all verifications for one experiment to one person, usually the spokesperson or data-analysis coordinator, who then distributes them to the appropriate people. Please tell us if we should send the verifications for your experiment to someone else.

Fabio Anulli

EMAIL: [anulli@slac.stanford.edu](mailto:anulli@slac.stanford.edu)

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July 21, 2016

Dear Colleague,

- (1) Please check the results of your experiment carefully. They are marked.
- (2) Please reply within one week.
- (3) Please reply even if everything is correct.
- (4) IMPORTANT!! Please tell WHICH papers you are verifying. We have lots of requests out.
- (5) Feel free to make comments on our treatment of any of the results (not just yours) you see.

Thank you for helping us make the Review accurate and useful.

Sincerely,

Simon Eidelman  
BINP, Budker Inst. of Nuclear Physics  
Prospekt Lavrent'eva 11  
RU-630090 Novosibirsk  
Russian Federation

EMAIL: [simon.eidelman@cern.ch](mailto:simon.eidelman@cern.ch)

# c $\bar{c}$ MESONS

NODE=MXXX025

NODE=M026

## $\eta_c(1S)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

### $\eta_c(1S)$ MASS

NODE=M026M

NODE=M026M

YOUR DATA  
YOUR DATA

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>2983.4 ± 0.5</b>	<b>OUR AVERAGE</b>	Error includes scale factor of 1.2.		
2982.2 ± 1.5 ± 0.1	2.0k	1 AAIJ	15BI	LHCB $pp \rightarrow \eta_c(1S)X$
2983.5 ± 1.4 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.6 \\ 3.6 \end{smallmatrix}$		2 ANASHIN	14	KEDR $J/\psi \rightarrow \gamma\eta_c$
2979.8 ± 0.8 ± 3.5	4.5k	3,4 LEES	14E	BABR $\gamma\gamma \rightarrow K^+K^-\pi^0$
2984.1 ± 1.1 ± 2.1	900	3,4,5 LEES	14E	BABR $\gamma\gamma \rightarrow K^+K^-\eta$
2984.3 ± 0.6 ± 0.6		6,7 ABLIKIM	12F	BES3 $\psi(2S) \rightarrow \gamma\eta_c$
2984.49 ± 1.16 ± 0.52	832	3 ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0\gamma$ hadrons
2982.7 ± 1.8 ± 2.2	486	ZHANG	12A	BELL $e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
2984.5 ± 0.8 ± 3.1	11k	DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
2985.4 ± 1.5 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.5 \\ 2.0 \end{smallmatrix}$	920	7 VINOKUROVA	11	BELL $B^\pm \rightarrow K_S^\pm(K_S^0K^\pm\pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	8 LEES	10	BABR $10.6 e^+e^- \rightarrow e^+e^-K_S^0K^\pm\pi^\mp$
2985.8 ± 1.5 ± 3.1	0.9k	AUBERT	08AB	BABR $B \rightarrow \eta_c(1S)K(*) \rightarrow K\bar{K}\pi K(*)$
2986.1 ± 1.0 ± 2.5	7.5k	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c \rightarrow$ hadrons
2970 ± 5 ± 6	501	9 ABE	07	BELL $e^+e^- \rightarrow J/\psi(c\bar{c})$
2971 ± 3 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 2 \\ 1 \end{smallmatrix}$	195	WU	06	BELL $B^+ \rightarrow p\bar{p}K^+$
2974 ± 7 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 2 \\ 1 \end{smallmatrix}$	20	WU	06	BELL $B^+ \rightarrow \Lambda\bar{\Lambda}K^+$
2981.8 ± 1.3 ± 1.5	592	ASNER	04	CLEO $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0K^\pm\pi^\mp$
2984.1 ± 2.1 ± 1.0	190	10 AMBROGIANI	03	E835 $\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2982.5 ± 0.4 ± 1.4	12k	11 DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K_S^0K^\pm\pi^\mp$
2982.2 ± 0.6		12 MITCHELL	09	CLEO $e^+e^- \rightarrow \gamma X$
2982 ± 5	270	13 AUBERT	06E	BABR $B^\pm \rightarrow K^\pm X_{c\bar{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	14 AUBERT	04D	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
2977.5 ± 1.0 ± 1.2		12,15 BAI	03	BES $J/\psi \rightarrow \gamma\eta_c$
2979.6 ± 2.3 ± 1.6	180	16 FANG	03	BELL $B \rightarrow \eta_c K$
2976.3 ± 2.3 ± 1.2		12,17 BAI	00F	BES $J/\psi, \psi(2S) \rightarrow \gamma\eta_c$
2976.6 ± 2.9 ± 1.3	140	12,18 BAI	00F	BES $J/\psi \rightarrow \gamma\eta_c$
2980.4 ± 2.3 ± 0.6		19 BRANDENB...	00B	CLE2 $\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0\pi^\mp$
2975.8 ± 3.9 ± 1.2		18 BAI	99B	BES Sup. by BAI 00F
2999 ± 8	25	ABREU	98O	DLPH $e^+e^- \rightarrow e^+e^- +$ hadrons
2988.3 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 3.3 \\ 3.1 \end{smallmatrix}$		ARMSTRONG	95F	E760 $\bar{p}p \rightarrow \gamma\gamma$
2974.4 ± 1.9		12,20 BISELLO	91	DM2 $J/\psi \rightarrow \eta_c\gamma$
2969 ± 4 ± 4	80	12 BAI	90B	MRK3 $J/\psi \rightarrow \gamma K^+K^-K^+K^-$
2956 ± 12 ± 12		12 BAI	90B	MRK3 $J/\psi \rightarrow \gamma K^+K^-K_S^0K_L^0$
2982.6 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 2.7 \\ 2.3 \end{smallmatrix}$	12	BAGLIN	87B	SPEC $\bar{p}p \rightarrow \gamma\gamma$
2980.2 ± 1.6		12,20 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$
2984 ± 2.3 ± 4.0		12 GAISER	86	CBAL $J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
2976 ± 8		12,21 BALTRUSAIT..84	MRK3	$J/\psi \rightarrow 2\phi\gamma$
2982 ± 8	18	22 HIMEL	80B	MRK2 $e^+e^-$
2980 ± 9		22 PARTRIDGE	80B	CBAL $e^+e^-$

- 1 AAIJ 15BI reports  $m_{J/\psi} - m_{\eta_c(1S)} = 114.7 \pm 1.5 \pm 0.1$  MeV from a sample of  $\eta_c(1S)$  and  $J/\psi$  produced in  $b$ -hadron decays. We have used current value of  $m_{J/\psi} = 3096.900 \pm 0.006$  MeV to arrive at the quoted  $m_{\eta_c(1S)}$  result.
- 2 Taking into account an asymmetric photon lineshape.
- 3 With floating width.
- 4 Ignoring possible interference with the non-resonant  $0^-$  amplitude.
- 5 Using both,  $\eta \rightarrow \gamma\gamma$  and  $\eta \rightarrow \pi^+\pi^-\pi^0$  decays.
- 6 From a simultaneous fit to six decay modes of the  $\eta_c$ .
- 7 Accounts for interference with non-resonant continuum.
- 8 Taking into account interference with the non-resonant  $J^P = 0^-$  amplitude.
- 9 From a fit of the  $J/\psi$  recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.
- 10 Using mass of  $\psi(2S) = 3686.00$  MeV.
- 11 Not independent from the measurements reported by LEES 10.
- 12 MITCHELL 09 observes a significant asymmetry in the lineshapes of  $\psi(2S) \rightarrow \gamma\eta_c$  and  $J/\psi \rightarrow \gamma\eta_c$  transitions. If ignored, this asymmetry could lead to significant bias whenever the mass and width are measured in  $\psi(2S)$  or  $J/\psi$  radiative decays.
- 13 From the fit of the kaon momentum spectrum. Systematic errors not evaluated.
- 14 Superseded by LEES 10.
- 15 From a simultaneous fit of five decay modes of the  $\eta_c$ .
- 16 Superseded by VINOKUROVA 11.
- 17 Weighted average of the  $\psi(2S)$  and  $J/\psi(1S)$  samples. Using an  $\eta_c$  width of 13.2 MeV.
- 18 Average of several decay modes. Using an  $\eta_c$  width of 13.2 MeV.
- 19 Superseded by ASNER 04.
- 20 Average of several decay modes.
- 21  $\eta_c \rightarrow \phi\phi$ .
- 22 Mass adjusted by us to correspond to  $J/\psi(1S)$  mass = 3097 MeV.

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NODE=M026M;LINKAGE=D

NODE=M026M;LINKAGE=E  
NODE=M026M;LINKAGE=AL  
NODE=M026M;LINKAGE=LS  
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NODE=M026M;LINKAGE=B  
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### $\eta_c(1S)$ WIDTH

NODE=M026W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>31.9± 1.0 OUR AVERAGE</b> Error includes scale factor of 1.2.				
27.2± 3.1 <sup>+5.4</sup> <sub>-2.6</sub>		<sup>1</sup> ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma\eta_c$
25.2± 2.6±2.4	4.5k	<sup>2,3</sup> LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\pi^0$
34.8± 3.1±4.0	900	<sup>2,3,4</sup> LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\eta$
32.0± 1.2±1.0		<sup>5,6</sup> ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma\eta_c$
36.4± 3.2±1.7	832	<sup>2</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma$ hadrons
37.8 <sup>+</sup> <sub>-5.3</sub> ±3.1	486	ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
36.2± 2.8±3.0	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
35.1± 3.1 <sup>+1.0</sup> <sub>-1.6</sub>	920	<sup>6</sup> VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm(K_S^0 K^\pm\pi^\mp)$
31.7± 1.2±0.8	14k	<sup>7</sup> LEES	10 BABR	$10.6 e^+e^- \rightarrow e^+e^-K_S^0 K^\pm\pi^\mp$
36.3 <sup>+</sup> <sub>-3.6</sub> ±4.4	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S)K(*) \rightarrow K\bar{K}\pi K(*)$
28.1± 3.2±2.2	7.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow$ hadrons
48 <sup>+</sup> <sub>-7</sub> ±5	195	WU	06 BELL	$B^+ \rightarrow \rho\bar{p}K^+$
40 ±19 ±5	20	WU	06 BELL	$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$
24.8± 3.4±3.5	592	ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm\pi^\mp$
20.4 <sup>+</sup> <sub>-6.7</sub> ±2.0	190	AMBROGIANI	03 E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
23.9 <sup>+</sup> <sub>-7.1</sub> ±12.6		ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
32.1± 1.1±1.3	12k	<sup>8</sup> DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm\pi^\mp$
34.3± 2.3±0.9	2.5k	<sup>9</sup> AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
17.0± 3.7±7.4		<sup>10</sup> BAI	03 BES	$J/\psi \rightarrow \gamma\eta_c$
29 ± 8 ±6	180	<sup>11</sup> FANG	03 BELL	$B \rightarrow \eta_c K$
11.0± 8.1±4.1		<sup>12</sup> BAI	00F BES	$J/\psi \rightarrow \gamma\eta_c$ and $\psi(2S) \rightarrow \gamma\eta_c$
27.0± 5.8±1.4		<sup>13</sup> BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0\pi^\mp$
7.0 <sup>+</sup> <sub>-7.0</sub> ±7.5	12	BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$
10.1 <sup>+</sup> <sub>-8.2</sub> ±33.0	23	<sup>14</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma p\bar{p}$

NODE=M026W

OCCUR=2

OCCUR=2

OCCUR=2

YOUR DATA  
YOUR DATA

11.5 ± 4.5			GAISER	86	CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
< 40 90% CL	18		HIMEL	80B	MRK2	$e^+e^-$
< 20 90% CL			PARTRIDGE	80B	CBAL	$e^+e^-$

- 1 Taking into account an asymmetric photon lineshape.  
2 With floating mass.  
3 Ignoring possible interference with the non-resonant  $0^-$  amplitude.  
4 Using both,  $\eta \rightarrow \gamma\gamma$  and  $\eta \rightarrow \pi^+\pi^-\pi^0$  decays.  
5 From a simultaneous fit to six decay modes of the  $\eta_c$ .  
6 Accounts for interference with non-resonant continuum.  
7 Taking into account interference with the non-resonant  $J^P = 0^-$  amplitude.  
8 Not independent from the measurements reported by LEES 10.  
9 Superseded by LEES 10.  
10 From a simultaneous fit of five decay modes of the  $\eta_c$ .  
11 Superseded by VINOKUROVA 11.  
12 From a fit to the 4-prong invariant mass in  $\psi(2S) \rightarrow \gamma\eta_c$  and  $J/\psi(1S) \rightarrow \gamma\eta_c$  decays.  
13 Superseded by ASNER 04.  
14 Positive and negative errors correspond to 90% confidence level.

NODE=M026W;LINKAGE=A  
NODE=M026W;LINKAGE=AL  
NODE=M026W;LINKAGE=LS  
NODE=M026W;LINKAGE=EL  
NODE=M026W;LINKAGE=BL  
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NODE=M026W;LINKAGE=DE  
NODE=M026W;LINKAGE=UB  
NODE=M026W;LINKAGE=AK  
NODE=M026W;LINKAGE=FA  
NODE=M026W;LINKAGE=KZ  
NODE=M026W;LINKAGE=NN  
NODE=M026W;LINKAGE=L

## $\eta_c(1S)$ BRANCHING RATIOS

NODE=M026225

### HADRONIC DECAYS

NODE=M026305

$\Gamma(f_0(980)\eta)/\Gamma_{\text{total}}$   $\Gamma_{17}/\Gamma$   
VALUE DOCUMENT ID TECN COMMENT

NODE=M026R41  
NODE=M026R41

YOUR DATA **seen** LEES 14E BABR Dalitz anal. of  $\eta_c \rightarrow K^+K^-\eta$

$\Gamma(f_0(1500)\eta)/\Gamma_{\text{total}}$   $\Gamma_{18}/\Gamma$   
VALUE DOCUMENT ID TECN COMMENT

NODE=M026R42  
NODE=M026R42

YOUR DATA **seen** LEES 14E BABR Dalitz anal. of  $\eta_c \rightarrow K^+K^-\eta$

$\Gamma(f_0(2200)\eta)/\Gamma_{\text{total}}$   $\Gamma_{19}/\Gamma$   
VALUE DOCUMENT ID TECN COMMENT

NODE=M026R43  
NODE=M026R43

YOUR DATA **seen** LEES 14E BABR Dalitz anal. of  $\eta_c \rightarrow K^+K^-\eta$

$\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$   $\Gamma_{20}/\Gamma$   
VALUE DOCUMENT ID TECN COMMENT

NODE=M026R44  
NODE=M026R44

YOUR DATA **seen** LEES 14E BABR Dalitz anal. of  $\eta_c \rightarrow K^+K^-\pi^0$

$\Gamma(a_0(1320)\pi)/\Gamma_{\text{total}}$   $\Gamma_{21}/\Gamma$   
VALUE DOCUMENT ID TECN COMMENT

NODE=M026R45  
NODE=M026R45

YOUR DATA **seen** LEES 14E BABR Dalitz anal. of  $\eta_c \rightarrow K^+K^-\pi^0$

$\Gamma(a_0(1450)\pi)/\Gamma_{\text{total}}$   $\Gamma_{22}/\Gamma$   
VALUE DOCUMENT ID TECN COMMENT

NODE=M026R46  
NODE=M026R46

YOUR DATA **seen** LEES 14E BABR Dalitz anal. of  $\eta_c \rightarrow K^+K^-\pi^0$

$\Gamma(K_0^*(1430)\bar{K})/\Gamma_{\text{total}}$   $\Gamma_{25}/\Gamma$   
VALUE EVTS DOCUMENT ID TECN COMMENT

NODE=M026R47  
NODE=M026R47

YOUR DATA **seen** 12k <sup>1</sup>LEES 16A BABR  $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$   
**seen** LEES 14E BABR Dalitz anal. of  $\eta_c \rightarrow K^+K^-\eta/\pi^0$

- <sup>1</sup> From a model-independent partial wave analysis.

NODE=M026R47;LINKAGE=A

$\Gamma(K_2^*(1430)\bar{K})/\Gamma_{\text{total}}$   $\Gamma_{26}/\Gamma$   
VALUE DOCUMENT ID TECN COMMENT

NODE=M026R48  
NODE=M026R48

YOUR DATA **seen** LEES 14E BABR Dalitz anal. of  $\eta_c \rightarrow K^+K^-\pi^0$

$\Gamma(K_0^*(1950)\bar{K})/\Gamma_{\text{total}}$   $\Gamma_{27}/\Gamma$   
VALUE EVTS DOCUMENT ID TECN COMMENT

NODE=M026R49  
NODE=M026R49

YOUR DATA **seen** 12K <sup>1</sup>LEES 16A BABR  $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$   
**seen** LEES 14E BABR Dalitz anal. of  $\eta_c \rightarrow K^+K^-\eta/\pi^0$

- <sup>1</sup> From a Dalitz plot analysis using an isobar model.

NODE=M026R49;LINKAGE=A

$\Gamma(K\bar{K}\eta)/\Gamma(K\bar{K}\pi)$  $\Gamma_{29}/\Gamma_{28}$ 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.190±0.008±0.017</b>	5.4k	<sup>1</sup> LEES	14E BABR	$\gamma\gamma \rightarrow K^+ K^- \eta/\pi^0$

NODE=M026R40  
 NODE=M026R40

YOUR DATA

YOUR NOTE

<sup>1</sup> LEES 14E reports  $B(\eta_c(1S) \rightarrow K^+ K^- \eta)/B(\eta_c(1S) \rightarrow K^+ K^- \pi^0) = 0.571 \pm 0.025 \pm 0.051$ , which we divide by 3 to account for isospin symmetry. It uses both  $\eta \rightarrow \gamma\gamma$  and  $\eta \rightarrow \pi^+ \pi^- \pi^0$  decays.

NODE=M026R40;LINKAGE=LE

 $\eta_c(1S)$  REFERENCES

LEES	AAIJ	ANASHIN	LEES	ABLIKIM	ZHANG	DEL-AMO-SA...	VINOKUROVA	LEES	MITCHELL	AUBERT	UEHARA	ABE	AUBERT	WU	ABE	ASNER	AUBERT	AMBROGIANI	BAI	FANG	ABE,K	BAI	BRANDENB...	BAI	ABREU	ARMSTRONG	BISELLO	BAI	BAGLIN	BALTRUSAIT...	GAISER	BALTRUSAIT...	HIMEL	PARTRIDGE
16A	15BI	14	14E	12F	12A	11M	11	10	09	08AB	08	07	06E	06	04G	04	04D	03	03	03	02	00F	00B	99B	98O	95F	91	90B	87B	86	86	84	80B	80B
PR D93 012005	EPJ C75 311	PL B738 391	PR D89 112004	PRL 108 222002	PR D86 052002	PR D84 012004	PL B706 139	PR D81 052010	PRL 102 011801	PR D78 012006	EPJ C53 1	PRL 98 082001	PRL 96 052002	PRL 97 162003	PR D70 071102	PRL 92 142001	PRL 92 142002	PL B566 45	PL B555 174	PRL 90 071801	PRL 89 142001	PR D62 072001	PRL 85 3095	PR D60 072001	PL B441 479	PR D52 4839	NP B350 1	PR 65 1309	PL B187 191	PR D33 629	PR D34 711	PRL 52 2126	PRL 45 1146	PRL 45 1150
J.P. Lees <i>et al.</i>	R. Aaij <i>et al.</i>	V.V. Anashin <i>et al.</i>	J.P. Lees <i>et al.</i>	M. Ablikim <i>et al.</i>	C.C. Zhang <i>et al.</i>	P. del Amo Sanchez <i>et al.</i>	A. Vinokurova <i>et al.</i>	J.P. Lees <i>et al.</i>	R.E. Mitchell <i>et al.</i>	B. Aubert <i>et al.</i>	S. Uehara <i>et al.</i>	K. Abe <i>et al.</i>	B. Aubert <i>et al.</i>	C.-H. Wu <i>et al.</i>	K. Abe <i>et al.</i>	D.M. Asner <i>et al.</i>	B. Aubert <i>et al.</i>	M. Ambrogiani <i>et al.</i>	J.Z. Bai <i>et al.</i>	F. Fang <i>et al.</i>	K. Abe <i>et al.</i>	J.Z. Bai <i>et al.</i>	G. Brandenburg <i>et al.</i>	J.Z. Bai <i>et al.</i>	P. Abreu <i>et al.</i>	T.A. Armstrong <i>et al.</i>	D. Bisello <i>et al.</i>	Z. Bai <i>et al.</i>	C. Baglin <i>et al.</i>	R.M. Baltrusaitis <i>et al.</i>	J. Gaiser <i>et al.</i>	R.M. Baltrusaitis <i>et al.</i>	T.M. Himel <i>et al.</i>	R. Partridge <i>et al.</i>
(BABAR Collab.)	(LHCb Collab.)	(KEDR Collab.)	(BABAR Collab.)	(BES III Collab.)	(BES III Collab.)	(BABAR Collab.)	(BELLE Collab.)	(BABAR Collab.)	(CLEO Collab.)	(BABAR Collab.)	(BELLE Collab.)	(BELLE Collab.)	(BABAR Collab.)	(BELLE Collab.)	(BELLE Collab.)	(CLEO Collab.)	(BABAR Collab.)	(FNAL E835 Collab.)	(BES Collab.)	(BELLE Collab.)	(BELLE Collab.)	(BES Collab.)	(CLEO Collab.)	(BES Collab.)	(DELPHI Collab.)	(FNAL, FERR, GENO+)	(DM2 Collab.)	(Mark III Collab.)	(R704 Collab.)	(Mark III Collab.)	(Crystal Ball Collab.)	(CIT, UCSC+) JP	(SLAC, LBL, UCB)	(CIT, HARV, PRIN+)

NODE=M026

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 REFID=57147  
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 REFID=54271  
 REFID=54741  
 REFID=54763  
 REFID=16751  
 REFID=53927  
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 REFID=51472  
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 REFID=49185  
 REFID=49206  
 REFID=49188  
 REFID=48546  
 REFID=48553  
 REFID=47385  
 REFID=46553  
 REFID=44623  
 REFID=41668  
 REFID=41354  
 REFID=40018  
 REFID=22009  
 REFID=22012  
 REFID=22006  
 REFID=22003  
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 NODE=M059

 $\eta_c(2S)$ 

$$I^G(J^{PC}) = 0^+(0^-+)$$

Quantum numbers are quark model predictions.

NODE=M059

 $\eta_c(2S)$  MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>3639.2±1.2 OUR AVERAGE</b>				

NODE=M059M

NODE=M059M

YOUR DATA

YOUR DATA

3637.0±5.7±3.4	178	<sup>1,2</sup> LEES	14E BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^0$
3635.1±5.8±2.1	47	<sup>1,3</sup> LEES	14E BABR	$\gamma\gamma \rightarrow K^+ K^- \eta$
3646.9±1.6±3.6	57 ± 17	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
3637.6±2.9±1.6	127 ± 18	<sup>4</sup> ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi,$ $K K \pi^0$
3638.5±1.5±0.8	624	<sup>1</sup> DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
3640.5±3.2±2.5	1201	<sup>1</sup> DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
3636.1 <sup>+3.9+0.7</sup> <sub>-4.2-2.0</sub>	128	<sup>5</sup> VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm(K_S^0 K^\pm \pi^\mp)$
3626 ±5 ±6	311	<sup>6</sup> ABE	07 BELL	$e^+ e^- \rightarrow J/\psi(c\bar{c})$
3645.0±5.5 <sup>+4.9</sup> <sub>-7.8</sub>	121 ± 27	AUBERT	05C BABR	$e^+ e^- \rightarrow J/\psi c\bar{c}$
3642.9±3.1±1.5	61	ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3639 ±7	98 ± 52	<sup>7</sup> AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
3630.8±3.4±1.0	112 ± 24	<sup>8</sup> AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
3654 ±6 ±8	39 ± 11	<sup>9</sup> CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
3594 ±5		<sup>10</sup> EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

OCCUR=2

OCCUR=2

- YOUR NOTE 1 Ignoring possible interference with continuum.  
 YOUR NOTE 2 With a width fixed to 11.3 MeV.  
 YOUR NOTE 3 With a width fixed to 11.3 MeV. Using both  $\eta \rightarrow \gamma\gamma$  and  $\eta \rightarrow \pi^+\pi^-\pi^0$  decays.  
 4 From a simultaneous fit to  $K_S^0 K^\pm \pi^\mp$  and  $K^+ K^- \pi^0$  decay modes.  
 5 Accounts for interference with non-resonant continuum.  
 6 From a fit of the  $J/\psi$  recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.  
 7 From the fit of the kaon momentum spectrum. Systematic errors not evaluated.  
 8 Superseded by DEL-AMO-SANCHEZ 11M.  
 9 Superseded by VINOKUROVA 11.  
 10 Assuming mass of  $\psi(2S) = 3686$  MeV.

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### $\eta_c(2S)$ BRANCHING RATIOS

	$\Gamma(K\bar{K}\eta)/\Gamma(K\bar{K}\pi)$					$\Gamma_3/\Gamma_2$
	VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT	
YOUR DATA	<b><math>27.3 \pm 7.0 \pm 5.7</math></b>	225	<sup>28</sup> LEES	14E BABR	$\gamma\gamma \rightarrow K^+ K^- \gamma\gamma$	
YOUR NOTE	<sup>28</sup> LEES 14E reports $B(\eta_c(2S) \rightarrow K^+ K^- \eta)/B(\eta_c(2S) \rightarrow K^+ K^- \pi^0) = 0.82 \pm 0.21 \pm 0.17$ , which we divide by 3 to account for isospin symmetry.					

NODE=M059220

NODE=M059R26  
 NODE=M059R26

NODE=M059R26;LINKAGE=LE

### $\eta_c(2S)$ REFERENCES

YOUR PAPER						
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55937	
ABLIKIM	13K	PR D87 052005	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54956	
ABLIKIM	12G	PRL 109 042003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54272	
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751	
VINOKUROVA	11	PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=53927	
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627	
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059	
AUBERT	05C	PR D72 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50773	
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182	
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=49745	
AUBERT	04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49746	
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188	
CHOI	02	PRL 89 102001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=48760	
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22173	

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